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Utilization and Land Cover Examined in Two Blue Earth County Streams

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Utilization and Land Cover Examined in Two Blue Earth County Streams

EDITOR'S NOTE — In separate studies conducted over related geographic areas, students of Dr. Henry W. Quade of Mankato (Minnesota) State University have examined ecological relationships and land utilization patterns along several streams in south central Minnesota. The two reports which follow focus, respectively, on the Blue Earth River and LeSueur River valleys; and both have referred to a historically-based study in the same region reported in Volume 46, Number 2, of the *Journal* of the Minnesota Academy of Science.

The Blue Earth River

MARK GAMM*

ABSTRACT — Examining soil mapping units of the United States Agriculture department's Soil Conservation Service for comparison with land usage in the Blue Earth River valley, this study found that seven of 56 units in the valley accounted for 76.5 percent of the study terrain. Agricultural use or non-use of the land units matched established designations.

The relationship of soils to land-use is not always clear-cut because factors such as proximity to farming operations, access, and ownership enter into the picture. The purpose of this study is to examine the relationship of soils to land use in a portion of the Blue Earth River valley in south central Minnesota. Corrie Schaffer Cowley, reported in 1979, on the changes in land-use between 1938 and 1974 within a portion of the Blue Earth River valley. A significant decrease in the category "scrub and other" was found, with an increase in "trees". The "row crop" category remained unchanged over that period. She hypothesizes that the changes are due to a decrease in cattle grazing in the river valley with the resultant succession back to flood plain forest. The present study utilizes Cowley's study area, which is the section of the Blue Earth River valley from the Fairbault-Blue Earth county line to a point near the Watonwan River-Blue Earth River confluence, a river length of about 40 miles.

The river valley was considered to include the valley bottom and the often steep-sloped sides. The valley boundary was determined from stereoscopic viewing of 1938-39 aerial photographs.

Cowley assigned all the area of the valley to one of four land-use categories: River, Row Crop, Tree, or Shrub and Other. "River" included the water-filled channel itself as well as barren islands and shores. Oxbow lakes and larger vegetated islands were not considered in this category. "Row Crop" included cleared, plowed and planted fields regardless of crop. No attem-

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BLUE EARTH RIVER VALLEY

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The Le Sueur River Area

ROBERT JAMES CHILDS*

ABSTRACT — The LeSueur River flows for about 40 miles within Blue Earth county of south central Minnesota. Land cover in the valley, as determined by stereoscopic examination of aerial photographs, shows forest on 65 percent, agriculture on 22 percent, and other cover on 13 percent of the land. This differs significantly from findings of an earlier study of the Blue Earth River in the same county.

Within Blue Earth County in Minnesota, the Le Sueur River contains about 40 miles of river channel on a straight line of about 15 miles. The river water drops 200 plus-minus 10 feet as it travels over this distance. This study sought to compare the land-cover observed within the Le Sueur River Valley with land cover there as reported in an earlier study (Corrie Schaffer Cowley, 1938 - 1974). Minnesota Academy of Science Journal, Vol. 46, No. 2, 1980.

This survey covers the Le Sueur River Valley as assessed by the author. It includes the river channel, valley walls, and natural tributaries less than two miles long.

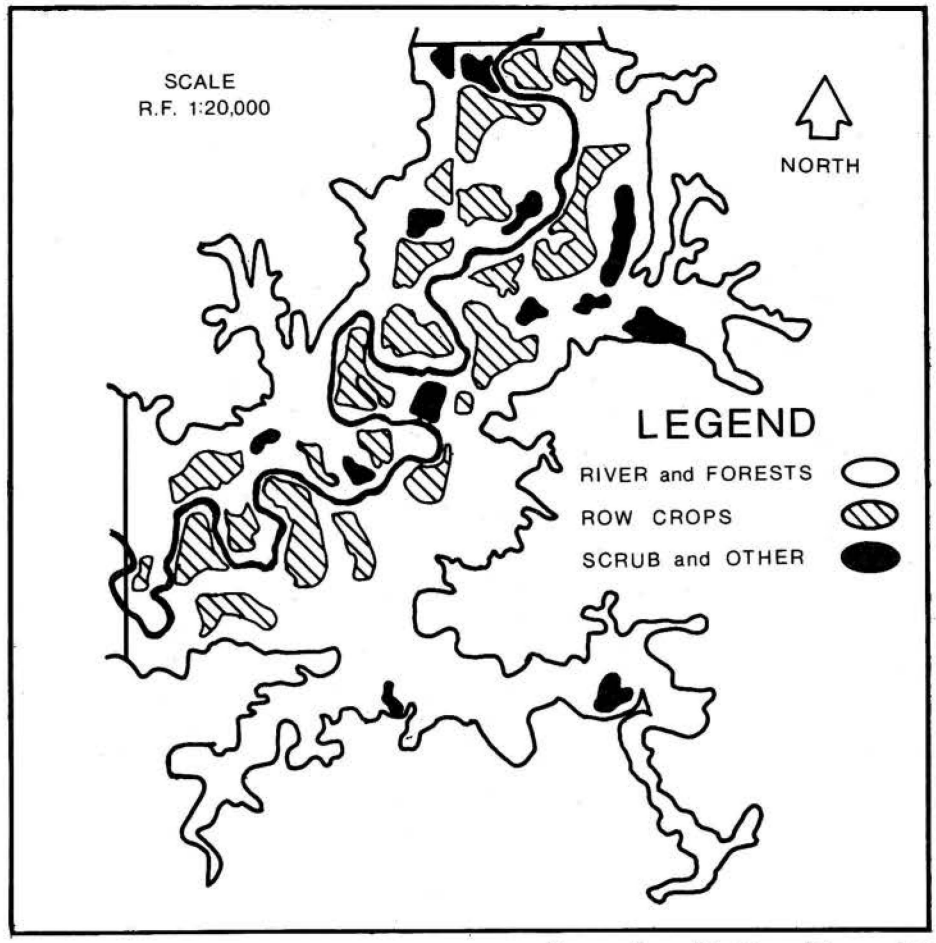
The aerial photos used in this investigation were obtained from the EROS Data Center in Sioux Falls, South Dakota, and consisted of black and white United States Geological Survey Aerial Mapping Photos. These photos are 9 by 9 inches in format, and have a nominal scale of 1-20,000, or one inch equals about seventeen hundred feet.

Ten photos were viewed using a mirrored stereoscopic device. This device, with overlapping photos, enables the viewer to observe changes in surface elevations. The appropriate 1973 United States Geological Survey 7½ minute topographic maps, produced from these same photos, also were used to aid in determining the valley boundaries.

The valley boundaries were judged to be the point where there was a significant increase in slope to the river channel or the drop-off point, from the relatively level surface, to the valley floor. The valley boundaries were then drawn on overlay transparencies, and for ease in photographic reproduction.

All of the lands in the valley were classified into three groups: Forested, agricultural, or scrub. The forested land included the

*ROBERT JAMES CHILDS was an undergraduate student at Mankato (Minnesota) State University in Environmental Studies and Geography when this project was undertaken.



river channel and all dense tree covered land that restricted determination of understory. The agricultural land included land that showed visible signs of row crop agriculture. The scrub or other included open non-forested land. This group included pasture, wetlands, residential developments, gravel pits, ponds, and other un-determined landcover; inside the valley boundaries. A sample land cover 9 x 9 format is seen in Figure 1. The patchiness of the row crop and scrub observed is typical of all ten 9 x 9 aerial photographs used in this study. Homesites, roads, railroads, and areas of less than five acres were not separated out of land-cover groups.

After the land cover was determined, classified, and outlined on the transparencies, the surface areas were measured. Two methods were used, the dot grid counting method, and the area digital calculator method. The dot grid counting method, used an overlay transparency, with a .01 square inch per unit grid printed on it. This overlay was then placed over the area to be calculated. By counting the squares within the boundary, the area was determined. This was done three times and averaged. The area digital calculator method utilized a planimeter. The area measuring tool was also used three times to measure the areas and averaged.

The author reports here the area calculator results, instead of the dot grid results because the planimeter measures polygon shaped areas more accurately than counting square units in round shaped forms. The two methods, however, gave quite similar results. Error in this survey was figured to be the width of the lines drawn on the transparencies. The average width was about .06 of an inch or about 100 feet on the ground. The author used great care in production of linework. The outside of the line was used as the boundary point.

Comparison of Le Sueur River and Blue Earth River Valleys

Results of this survey showed that the 10,323 acres of the Le Sueur consisted of 65 percent forested land, 22 percent agricultural land, and 13 percent scrub or other. The area of the Le Sueur River Valley was determined to be about one fourth of the Blue Earth River Valley in Blue Earth County (Tabled I). From a relative point of view the shrub and other was similar in the two valleys. The forest or treed acreage was proportionately much higher in the Le Sueur River Valley and the relative proportion of the agricultural land much less (Table I).

The Le Sueur River Valley is much narrower than the Blue Earth River Valley within the study area, and this probably helps to account for the differences in that the forested slopes would be relatively more important.

	Le Sueur River Valley 1973 Childs	Blue Earth River Valley 1974 Cowley
Forest (Tree) (and River)	65%	43%
Agriculture	22%	45%
Scrub or Other	13%	12%
Total Acres	10,323	43,156

Table 1. - Dominant Soil Units in Blue Earth Valley Study Area.

ACKNOWLEDGEMENTS

The author expresses appreciation to Dr. Henry W. Quade of the Department of Biology at Mankato State University for advice and guidance throughout this study and thanks Dr. Phil Kelley, of the same university's Department of Geography for advice on interpretation of aerial photography.

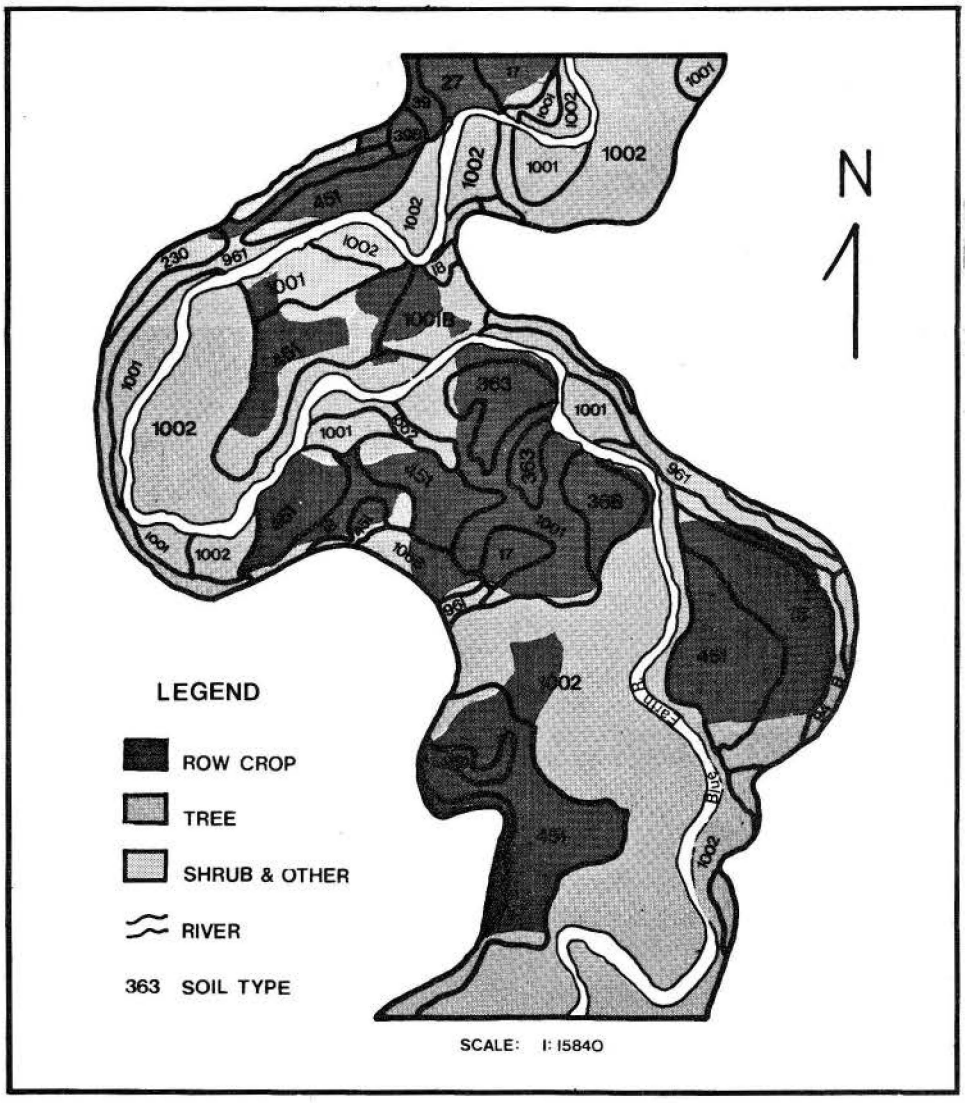


Figure 1 - Soil types and usage by mapping units

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pt was made to distinguish between cleared non-bushy fields used for pastures or fallow and those used for cash crops. "Trees" included areas of dense and complete tree cover. The presence or absence of understory was not determined. The category "Shrub and Other" included sparsely treed, brushy areas and other areas of substantial size not included in previous categories. Areas of less than 10 acres, roads, oxbow lakes, homesteads and other discontinuities were not separated out. It was usually appropriate to consider them part of the adjoining or surrounding category.

Measurements for correlation

To get quantitative data which correlates soil type to land-use, the 1974 aerial photographs were enlarged to the same size as Blue Earth County Soil Atlas sheets. This meant enlarging the scale of 1974 photographs from a ratio of 1:24000 to a scale of 1:15840, the enlargements being achieved by use of a Map-o-graph image machine. At this time, both the land-use categories and the soil types were traced on a single sheet of transparent film.

The next step was to digitize the area of soil type within each land use category. (Figure I). Individual soil type areas were measured with a Numonic Corporation's Electronic Graphics Calculator. The graphics calculator is made to digitize point coordinates in square inches. Since this study utilized a scale of 1:15840, the calculator was digitizing at a scale of 1 sq. inch = 40 acres. (1:15840 = 1" to 15840" or 1" = 1320 feet or 1 sq." = 40 1742400 sq.'. Since an acre is 43,560 sq.', 1 sq." on the graphic calculator equaled 40 acres on the ground.) Each area was measured at least twice and an average was determined.

This survey covers 56 of 131 units

Quaternary deposits in Blue Earth county are glacial till, lacustrine, and outwash. The youthful glacial land has poorly developed natural drainage patterns, level ground morains, and a few large entrenched streams. The Blue Earth River, which enters the county from the south, is a large entrenched stream. Exposures along the river reveal complicated stratigraphy characterized by different tills that are superimposed.

The section of the Blue Earth River Valley used in this study contains 56 of the 131 soil mapping units designated in Blue Earth county, according to the U.S. Department of Agriculture SCS Soil Survey of the county, Minnesota. Each soil sample in the valley was categorized according to its land use and was digitized for acreage. The dominant mapping units are seen in Table I.

Soil No. 1002 made up 18.6 percent of the study area and it is characterized as Alluvial land, frequently flooded. The soil is

Table 1. Dominant Soil Units in Blue Earth Valley Study Area.

Soil mapping unit	% of soil unit in the total valley	% of soil unit in row crop	% of soil unit in trees	% of soil unit in shrub and other	% of row crop in soil unit	% of trees in soil unit	% of shrub and other in soil unit
1002	18.6	5.2	82.1	12.7	2.3	39.9	21.4
17	15.6	79.8	13.3	6.9	30.0	5.4	9.8
1001	13.2	42.3	44.5	12.8	13.4	15.4	10.8
961	9.3	*	79.3	20.7	*	19.1	16.7
WATER	8.2	*	*	*	*	*	*
248	8.1	86.6	12.1	1.3	16.6	2.5	0.9
363	6.7	58.4	31.6	10.0	9.3	5.4	5.9
451	5.0	67.5	17.5	15.0	8.2	2.3	6.9
18	4.3	68.3	15.8	15.8	7.2	1.9	6.9
349	1.6	22.0	41.4	36.6	0.9	1.7	5.4
94B	1.2	66.8	24.8	8.3	2.1	0.8	0.9
128B	0.7	42.9	7.7	49.4	0.7	0.1	3.2
329	0.7	75.0	1.7	23.3	1.3	*	1.4
41B	0.6	83.3	9.7	7.0	1.3	0.2	0.4
101B	0.5	20.8	50.5	28.7	0.2	0.6	1.2

usually found in stream bottom lands. Soil No. 1002 is mainly loam or silt loam and is not well suited for crop production because of frequent flooding during the growing season. The soil is generally used for undeveloped pasture and wildlife habitat. Eighty two percent of Soil No. 1002 is used for tree development and natural habitat (Table I). Almost 40 percent of all land covered by trees in this study area is found on Soil No. 1002. The 5 percent of Soil No. 1002 used for row crop may signify misutilization.

Soil No. 17, Minneopa sandy loam on 0 to 3 percent slopes, covers 15.6 percent of the Blue Earth River valley study area. It occupies stream terraces adjacent to Alluvial land above the level of most flooding. It is easy to till and responds well to fertilization. Almost 80 percent of this soil type is used for crop production. Thirty percent of all the row crops in the valley are grown in Minnepoa sandy loam (No. 17).

Soil No. 1001 is characterized al Alluvial land, occasionally flooded. This soil is much like soil No. 1002; found in bottom land, little or no slope, and is mainly loam or silt loam. It occupies 13.2 percent of the area and 42.3 percent is cropped. Soil No. 1001 is less apt to be flooded during the growing season, therefore, it is better for production of row crops (S.C.S., 1980).

Of the valley study area, 9.3 percent is in soil No. 961, which is the Storden Complex on very steep slopes of escarpments and ravines adjacent to major streams. The loamy and sandy soils are well drined and are potential eroision hazards (S.C.S., 1980). Table I shows that this Storden soil is most often in trees in the valley study area and that almost 17 percent of all shrub land found in the valley is located on the Storden Complex 961.

The Blue Earth River valley study area had 8.1 percent of its soil identified as No. 248 a Lomax loam with 1 to 3 degree slopes. This land occupies high terraces above the flood plain. Soil No. 248 is well suited for crop production. The main concern of management is slight droughtiness. Table I shows that almost 87 percent of the Soil No. 248 is used for crop production in the river valley study area. About 17 percent of cropland acreage in the study area is in soil No. 248.

Of Soil No. 41 B, Estherville sandy loam on 2 to 6 degree slopes, 83 percent is used for crop production in the Blue Earth River valley study area. This soil has 12 to 24 inches of loamy material over sand and gravel. Cultivating on this soil may lead to severe erosion problems, and erosion control practices are urged (S.C.S., 1980).

Seven dominant soil types noted

This study indicates that of the 56 soil mapping units in the river valley study, seven occupy 76.5 percent of the area. These seven soil mapping units range from 18.6 to 5.0 percent of the study area. These dominant seven categories include 79.8 percent of the total valley row crop land, 90.0 percent of the tree land, and 72.4 percent of the shrub land. Further, the study shows that those soils best suited for row crop agriculture were being used for agriculture and those ill suited were not. The two dominants - 17 and 1002 respectively, emphasize this conclusion.

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The author expresses appreciation to Dr. Henry W. Quade, Professor of Biology at Mankato State University for guidance throughout this project and thanks Dr. Phil Kelley, Professor of Geography at Mankato State, for guidance for the various methods utilized and Dick Paulson of the Soil Conservation Service at St. Peter, Minnesota, who reviewed the manuscript.